AD-A215 160

ON-PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
		Final (9/1/82-8/30/83

4. TITLE AND SUBTITLE

PROBABILISTIC ANALYSIS OF ALGORITHMS FOR NP-COMPLETE PROBLEMS

5. FUNDING NUMBERS

61102F
2304/A2

6. AUTHOR(S)

John Franco

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Case Western Reserve University
Computer Engineering and Science Department
Cleveland OH 44106

8. PERFORMING ORGANIZATION REPORT NUMBER

AFOSR-TR-89-1475

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

AFOSR
BLDG 410
BAFB DC 20332-6448

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

AFOSR-82-0331

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

During this period the investigator produced papers with titles, "Duality, finite improvement and efficiently solved optimization problems," "Swnsitivity of probabilistic results on algorithm for NP-complete problems to input distribution," and a third, being written now, "Probabilistic analysis of algorithms for the satisfiability problem." The first shows that it is highly unlikely that an NP-complete problem can be solved by any of a certain broad class of algorithms. The second shows that favorable results on a certain set of problems are misleading. That is if another input distribution is used the algorithms perform badly in the probabilistic sense. The main result in the third is that the satisfiability problem, an NP-complete problem, can be solved efficiently in the probabilistic sense under a distribution which causes no misleading results. The report summarizes results of research conducted under the grant during the inclusive dates.

14. SUBJECT TERMS

15. NUMBER OF PAGES
2

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
unclassified	unclassified		

NSN 7540-01-280-5500

Standard Form 298 (890104 Draft)
Prescribed by ANSI Std. 239-18
298-01

PROBABILISTIC ANALYSIS OF ALGORITHMS FOR NP-COMPLETE PROBLEMS

AFOSR Contract AFOSR-82-0331

JOHN FRANCO, Principal Investigator
CASE WESTERN RESERVE UNIVERSITY

Scientific Report
September, 1983

The first year of this project has resulted in material for three papers and this material was presented to about 40 members of the technical staff at the Institute for Defense Analysis. Two papers which have already been written are "Duality, Finite Improvement and Efficiently Solved Optimization Problems" and "Sensitivity of Probabilistic Results on Algorithms for NP-Complete Problems to Input Distribution". A third paper tentatively entitled "Probabilistic Analysis of Algorithms for the Satisfiability Problem" is being written now. The first paper shows that it is highly unlikely that an NP-complete problem can be solved by any of a certain broad class of algorithms. This statement has a negative impact on probabilistic results for NP-complete problems. The second paper presents some very favorable probabilistic results based on some commonly used input distributions. These results are obtained for extremely simple-minded algorithms based on techniques like search rearrangement. Some of these results were obtained by us and some by others. It is shown that in all the cases presented there is something misleading about the favorable results and that if another distribution F is used the algorithms perform badly in the probabilistic sense. The third paper presents algorithms which seem to perform well

under F in probability. Some of these algorithms are analyzed mathematically and some are analyzed empirically. The main result of this paper is that the satisfiability problem, an NP-complete problem, can be solved efficiently in the probabilistic sense under a distribution which causes no known misleading results.

The two talks that were presented to the Institute for Defense Analysis were based on the second and third papers.

The first paper was recently presented at the semi-annual Midwest Theory Conference and was recently submitted to Mathematics of Operations Research. The second paper was submitted to the Journal of the Association for Computing Machinery in September, 1983. All three papers will be sent to AFOSR in February or early March along with a more detailed report of progress.